

United States
Department of
Agriculture

Forest
Service

Forest
Pest
Management

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Subject: Evaluation of ponderosa pine mortality in the Clerkins Ranch area. (Report # NE 97-01)

To: District Ranger, Downieville Ranger District, Tahoe National Forest

At the request of Alan Doerr, District Silviculturist, I conducted a field evaluation of the Clerkins Ranch area on January 10, 1997. The objective of the evaluation was to determine what agents were involved with the ponderosa pine mortality and provide management alternatives for forest health restoration and maintenance.

The area examined is in T.18 N., R.9 E., Section 16 (see attached map). I was accompanied in the field by several members of the I.D. team. Participants included Jeannier Masquelier, District Ranger, Alan Doer, Project leader and Silviculturist, Kris Sexton, Fisheries Biologist, Marilyn Tierney, Wildlife Biologist, Terry Walsh, Assistant Project Leader, Dawn Koerber, Amphibians, Gary Fildes, Fuels and Air Quality, Laura Browning, NEPA Coordinator and Rick Weaver, Hydrologist.

Existing Condition

Species composition in the stand is 95% ponderosa pine with an average basal area of 200 sq. ft/acre. The site quality is very high, site I, and tree age averages about 80 years. The average diameter of trees >10" dbh is 26". The stands adjacent to this stand are mixed conifer, composed of ponderosa pine, Douglas-fir, sugar pine, incense cedar and black and live oak. Increment cores indicate that the ponderosa pine trees were growing quite well until about 20-25 years ago when the average radial growth slowed down substantially. The area we examined is within a spotted owl protected activity center (PAC).

Current and older ponderosa pine mortality exists throughout the area. There is a contiguous group kill encompassing about 35 acres in size located mostly within the PAC (see attached map). This group kill was detected on an aerial survey flight completed in September, 1996. There are also some groups (2-7 trees) of older mortality within and around the large group kill. Very few trees (<5) were found to have current beetle activity in them.

The ponderosa pine mortality which has occurred over the past several years has been caused by western pine beetle, Dendroctonus brevicornis. The trees in the large group kill had not faded and thus were not detected during an aerial survey conducted in the spring of last year. This indicates that the trees were either attacked late during the fall of 1995 and had not yet faded when the area was surveyed or were attacked at some point during the spring/early summer of 1996 and faded prior to the fall aerial survey. Red turpentine

beetle, Dendroctonus valens, pitch tubes were also present on many of the western pine beetle killed trees and some live trees. Some attacks were as high as 15 ft. up on the bole. Please see the attached information sheets on western pine beetle and red turpentine beetle biology.

Discussion

Historically, the most significant widespread, weather-related effect on the vegetation in California has been conifer mortality associated with severe moisture stress. Conifer mortality tends to increase whenever winter precipitation is less than about 80% of normal. Trees stressed by inadequate moisture levels have their normal defense systems weakened to the point that they are highly susceptible to attack by bark, engraver and wood-boring beetles. Bark beetle-related mortality in pine typically occurs as small groups of trees however large group kills are not uncommon during periods of protracted drought and/or other stress inducing conditions. Successful attacks by western pine beetles result in tree mortality. Although red turpentine beetle attacks do not normally caused tree mortality their presence is often an indicator of tree stress. It is unusual to find attacks above dbh unless the trees are severely stressed or the beetles are responding to fire-related damage, wounding or a thinning treatment.

The majority of the western pine beetle-related mortality has occurred over the past 2 years. Although precipitation was above normal for 1995, below normal precipitation was recorded nine of ten years (1984-1995) prior to that. Observations from previous droughts which were shorter in duration indicate that the response to increased moisture is not immediate and that a decline in mortality levels may not be apparent for 1-2 years following a normal precipitation period. These trees were growing well prior to about 25 years ago when growth declined dramatically. Specific factors attributed to the growth decline are not known; however, it is clear that these trees were not healthy or vigorous enough to withstand several years of drought combined with western pine beetle attacks. Typically during drought periods mortality levels are higher in overstocked stands. The current basal area of the ponderosa pine stand in the Clerkins Ranch area is not above what the site can support however during periods of protracted drought, mortality can be expected to occur throughout various stocking regimes.

Concern was expressed by several District personnel about the likelihood of the mortality expanding into nearby stands and into additional nearby PACs. The western pine beetles associated with the large group kill have already emerged. A limited survey of the immediate surrounding area indicated that there were very few trees under current attack. This pattern of mortality is commonly seen with western pine beetle. Observations of group kill dynamics in west-side Sierra Nevada stands do not suggest that western pine beetles consistently attack nearby pines upon emergence. Rather, the specific location of new group kills are unpredictable as beetles may fly for some unknown distance and direction before attacking a new host tree. Therefore, the surrounding stands have the same likelihood of being attacked as distant stands. If attacks were to occur in the surrounding stands the effects (a large contiguous group kill) would likely be less in the mixed conifer stands as only host trees (ponderosa pines) would be attacked and killed.

Effects resulting from bark beetles may include the following: direct tree mortality, openings that vary in size, less trees/acre, reduced canopy closure, increase in standing dead and down woody material, increase in fuel load, increase in decomposition and nutrient cycling, increase in species diversity/decrease in species diversity, increase in snags and cavity nesting opportunities and a change in species composition. The importance or significance of these effects depends on their severity and extent and ultimately how they affect (positively and/or negatively) ecosystem structure and function (desired condition) and specific management goals and objectives.

Management Alternatives

The following may be used to develop management alternatives leading in the direction of stand restoration and maintenance.

(1) No action - The effect of this alternative on future (1-2 years) levels of western pine beetle related mortality in the Clerkins Ranch area is minimal. As noted above, the population of bark beetles associated with the large group kill have already emerged therefore leaving or removing the trees will have no effect on subsequent mortality levels (see direct suppression below). Although some mortality is desired for snags, small openings and for future down woody debris, the no action alternative will most likely result in delaying the attainment of the stand components that contributed to spotted owl habitat. In addition, with no action, the large pocket of mortality may present an increase in fire hazard.

In general, mortality will be above background levels as stand density increases above that which the site can support. Mortality levels should be expected to increase during periods of below normal precipitation, particularly in overstocked stands. The direct result of an increase in tree mortality is the increase of standing dead (snags) and down woody material. This may result in: a continuing desire to enter stands to conduct salvage operations, an increase in fuel loading, fewer large, older trees and fewer of the mid-diameter trees that represent the pool from which the large trees and snags of the future come from and a short term increase in nutrient cycling.

(2) Salvage - Salvage sales can minimize the economic loss and reduce the amount of dead fuel, however, these operations will have no effect in reducing or controlling bark beetle populations. At the present time, there are no biologically effective or economically efficient methods available to reduce bark beetle populations on an area-wide basis such that tree mortality will be reduced to acceptable levels. As a general rule, during periods of above normal tree stress, it is recommended that logging, thinning and timber stand improvement work be minimized as much as possible to reduce the potential for additional stress. Where such activities must occur, extra care should be taken to prevent damage to residual trees.

(3) Thinning Overstocked Stands - Management activities that promote tree health and vigor also reduce the susceptibility of successful bark beetle attack; however, increased tree health and vigor will not be an immediate response. Thinning is perhaps the most critical silvicultural treatment available to restore and maintain forest health. Thinning from below reduces flammable fuels, and creates growing space for trees. Silvicultural

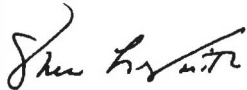
prescriptions designed to reduce basal area should result in lower levels of bark beetle-related mortality in the future. Reduced mortality would also have the effect of a reduction in the occurrence of understocked stands that would have low canopy closure. Mortality would continue to occur and fluctuate in response to the amount of available moisture, but at levels that, through time, would more closely approximate naturally occurring mortality levels. Thinning would result in a decrease in the need to enter stands to conduct salvage operations and a decrease in the amount of fuel loading (snags and down woody material would occur at more natural levels).

Snags, down woody material and nutrient cycling would occur at more natural levels. The improved growing conditions should result in reduced mortality of large diameter trees and an increase in mid-diameter trees available to grow into large diameter classes. Selecting for diversity of tree species during thinning and planting is desired as bark beetles are fairly host-specific and diversity should guarantee that some trees will remain alive during elevated stress periods. Dependent upon slash treatment, there would be some level of risk of subsequent top-kill and/or whole tree mortality to residual conifers due to pine engravers that reproduce in green slash.

Conclusion

Implementation of alternatives 2 and 3, combined with vegetation restoration activities in the large area killed by western pine beetle will most likely result in obtaining and maintaining the management goals and objectives for this area. Objectives to be considered may include restoring the resistance and resilience to natural stresses, decreasing the risk of catastrophic fires, and modifying the vegetation to reduce potential damages caused by insects and diseases.

If you have any questions regarding this evaluation or need additional assistance please call me at 916-257-2151 ext. 6667.



Sheri Lee Smith
Entomologist
NE CA Shared Service Area

Western pine beetle

The western pine beetle, Dendroctonus brevicomis, has been intensively studied and has proven to be an important factor in the ecology and management of ponderosa pine throughout the range of this host species. This insect breeds in the main bole of living ponderosa pine larger than about 4 inches dbh. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire. Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year.

Evidence of Attack

Initial attacks are made about mid-bole and subsequent attacks fill in above and below. Pitch tubes, formed on the tree trunk around the entry holes are made by the attacking females. The pitch tubes are red-brown masses of resin and boring dust. Relatively few, widely scattered, white pitch tubes usually indicate that the attacks were not successful and that the tree will survive. Pheromones released during a successful attack attract other western pine beetles. Attacking beetles may spill over onto nearby apparently healthy trees and overwhelm them by sheer numbers.

Life Stages and Development

These beetles pass through the egg, larval, pupal and adult stages during a life-cycle that varies in length dependent primarily upon temperature. Adults bore a sinuous gallery pattern in the cambium and the female lays eggs in niches along the sides. The larvae are small white grubs that first feed in the phloem and then mine into the middle bark where they complete most of their development. Bluestain fungi introduced during successful attacks probably contribute to the rapid tree mortality associated with bark beetle attacks.

Conditions Affecting Outbreaks

Outbreaks of western pine beetle have been observed, and surveys made, in pine regions of the West since 1899. An insect survey completed in 1917 in northern California indicated that over 25 million board feet of pine timber had been killed by bark beetles. Information from surveys initiated in the 1930s indicates that there were enormous losses attributed to western pine beetle around that time. During this outbreak, most of the mortality occurred in stands of mature or overmature trees of poor vigor.

Under normal conditions the western pine beetle breeds in a few overmature trees, unhealthy trees, or in trees weakened by drought, stand conditions, or fire. The availability of suitable host material is a key condition influencing western pine beetle outbreaks. In northeastern California, drought stress may be the key condition influencing outbreaks in that healthy trees undergo sudden and severe moisture stress and become suitable host material for attacking beetles. Healthy trees ordinarily produce abundant amounts of resin, which pitch out or eject attacking beetles. But, when deprived of moisture, stressed trees cannot produce sufficient resin flow to resist attack. Any condition that results in excessive demand for moisture, such as tree crowding, competing vegetation or protracted drought periods; or any condition that reduces that ability of the roots to supply water to the tree, such as

mechanical damage, root disease, or soil compaction, can cause moisture stress and increase susceptibility to attack by the western pine beetle. Woodpeckers, predaceous beetles and low winter temperatures are involved with natural control.

Red Turpentine Beetle

The red turpentine beetle, Dendroctonus valens, occurs throughout California and can breed in all species of pines. It normally attacks injured, weakened or dying trees and freshly cut stumps. The adults are attracted by fresh pine resin. They often attack wounded trees in campgrounds or following logging, trees scorched by wildfire or prescribed burns, lightning-struck trees and root-diseased trees exhibiting resinosis.

Attacks usually occur at the soil line or root crown and are characterized by a large reddish pitch tube at the point of entry. On severely stressed trees or during periods of drought, attacks may occur underground on the main roots up to 15 feet from the bole and also on the bole to a height of 10 feet. If an attack is successful, the adults excavate an irregular gallery in the cambium and the female lays eggs along the sides. The larvae feed in a mass and destroy an area of cambium ranging from 0.1 to 1.0 square feet. Attacks do not always kill trees but may predispose them to attack by other bark beetles. Repeated or extensive attacks by the red turpentine beetle can kill pines.

Attacks occur throughout warm weather and peak at mid-summer. The number of generations varies from two years for a single generation at the coldest portions of its range to two or three per year in the warmest.

Attacks can be minimized or prevented by avoiding soil compaction and injury to standing trees during logging or construction and also by insecticide application to high value trees.

**Bark Beetle Attacked Pine
Downieville R. D. - Tahoe N. F.
Clerkins Ranch Area
T.18 N., R. 9 E.**

Lat 39.43106 Lon -120.97887

Oct 7, 1996
A.Doerr

